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Dear Gerard

29 BERRY BROW, CLAYTON BRIDGE – PLANNING CONDITION 12

This letter summarises internal noise measurements undertaken within the completed development along Berry Brow, specifically relating to external noise break-in.

Criteria

We understand that Manchester City Council's Environmental Health Department's standard requirements are confirmed in the Planning Permission ref 106570/FO/2014/N1 dated 10 September 2014, where Condition 12 states:

"12. Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from nearby railway line shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data must include measurements taken during early morning rush-hour periods and night time to determine the appropriate sound insulation measures necessary.

The internal noise criterion are as follows:

- Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq
- Individual noise events should not normally exceed 45 dB LAmax (BS 8233:1999)
- Living Rooms (daytime - 07.00 - 23.00) 40 dB LAeq 106570/FO/2014/N1 Page 6 of 9
- Gardens and terraces (daytime) 55 dB LAeq

Reason- To secure a reduction in noise from traffic or other sources in order to protect future residents from noise disturbance, pursuant to policy DM1 of the Core Strategy."

Nasira Farooq from Manchester City Council has also clarified that the maximum noise criteria of 45dB LAmax,f should not be exceeded more than 15 times on any night.



robustdetails



Based on this criteria, the daytime and night-time average L_{Aeq} internal noise levels, as well as the number of exceedances during the night above 45dB $L_{Amax,f}$ have been assessed.

Measurement Procedure

Internal noise measurements were undertaken over a one day period between 15 and 16 August 2018, within the bedroom overlooking the railway line, and is considered to represent the worst-case noise levels around the development. Measurements of the L_{eq} and $L_{max,f}$ noise levels were undertaken in 5 minute samples in octave-bands between 63Hz to 8kHz.

The period of measurement is considered to represent a typical worst-case scenario, it being a weekday. A further review of the number of train passes experienced on other nights was conducted, and it was found that the number of train passes was representative of other nights.

The microphone was fixed to a tripod, approximately 1.2m above floor level. Measurements were undertaken in accordance ANC Guidelines *Noise Measurement in Buildings*.

During our measurements the rooms were clear of any soft furniture, which would be present when the rooms would be occupied. The amount of acoustic absorption present within a given room has an impact on the resultant noise level due to noise ingress, since less absorption results in higher internal noise levels as a greater amount of acoustic energy is reflected back into the room.

Measured noise levels were therefore not representative of an 'occupied' condition where soft furniture would be present. In order to correctly account for this change in reverberation time and therefore resultant internal noise levels, reverberation times were measured within the room.

The following equipment was used during the survey:

Table 1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406007	U28864	26 June 2020
Norsonic Pre Amplifier	1209	20043		
Norsonic ½" Microphone	1225	208146	28863	26 June 2020
Norsonic Sound Calibrator	1251	34127	U28862	26 June 2020

The equipment was calibrated both prior to and on completion of the survey, with no significant drift observed.

Reverberation Time Correction

The measured internal ambient noise levels in unfurnished rooms tend to be higher than those experienced in occupied, furnished rooms due to the lack of apparent absorption that will be offered by furniture, beds, chairs and rugs, etc. upon occupation. To allow for a correction to be made to the measured internal ambient noise levels in the unfurnished rooms, measurements were also made of the reverberation times (RTs) within the room and the measured RT values were used to calculate a corrected ("apparent") internal ambient noise level, as would be experienced in an occupied and furnished room.

The reverberation time measurements were carried out in accordance with BS EN ISO 3382-2. "Measurement of room acoustic parameters – Part 2: Reverberation time in ordinary rooms". Reverberation time measurements were carried out using the integrated impulse response method.

The measured reverberation times (T) which were used to correct the internal ambient noise levels are summarised below in Table 2.

Table 2 – Measured Reverberation Times (T)

Measured Reverberation Time (Seconds) at Octave Band Centre Frequency (Hz)								Overall Average (Seconds)
63	125	250	500	1k	2k	4k	8k	
0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.6	0.7

The dimensions of the sample rooms were measured on site so as to ascertain the total surface area (S in m²) of the rooms and their volumes (V in m³).

The following typical absorption coefficients (α), stated below in Table 3, have been used in our analyses to assess the effect of fully furnished rooms;

Table 3 – Typical Absorption Coefficients for Occupied & Furnished Bedroom

Room	Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Bedroom	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3

The "apparent" reverberation time (T₀) in occupied and furnished rooms was then calculated using the following formula:

$$T_0 = (0.161 * V) / A$$

Where T₀ is the apparent reverberation time, V is the volume of the room, and A is the equivalent absorption area (S*α). This is calculated on an octave band centre frequency basis.

The RT correction is then calculated using the following formula:

$$\text{RT Correction} = - 10 * \text{Log} (T / T_0)$$

This is then applied to the measured internal noise levels to arrive at the resultant "apparent" internal noise levels expected for an occupied and furnished room. The following table summarises the applied reverberation time corrections. The full calculation steps are provided in Appendix A attached.

Table 4 – Reverberation Time Corrections for Occupied & Furnished Bedroom

Correction (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0	-2	-4	-5	-5	-5	-5	-4

Results

Average Noise Levels

The following table summarises the results of our measurements, accounting for reverberation time corrections.

Table 5 – Measured & Predicted Average Noise Levels

		Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Daytime (07:00 – 23:00 hours)	Measured average SPL (L_{eq})	35	37	35	30	35	28	21	12	37
	Reverberation correction	0	-2	-4	-5	-5	-5	-5	-4	-
	Predicted average SPL (L_{eq})	35	36	31	25	30	23	16	8	32
Night-time (23:00 – 07:00 hours)	Measured average SPL (L_{eq})	29	31	30	25	30	24	18	11	32
	Reverberation correction	0	-2	-4	-5	-5	-5	-5	-4	-
	Predicted average SPL (L_{eq})	29	29	26	20	24	18	13	7	27

The uncorrected measured L_{Aeq} internal noise level time histories are presented in the attached Graph 1.

The reverberation-corrected internal noise levels are presented in the attached Graph 2.

Maximum Noise Levels

The uncorrected measured maximum ($L_{Amax,f}$) internal noise level time histories are presented in the attached Graph 3.

The reverberation corrected maximum internal noise levels are presented in the attached Graph 4.

The following table summarises the night-time maximum noise events above 45dBA $L_{Amax,f}$ in descending order. These values have been corrected for reverberation time, as per the L_{Aeq} results.

Table 6 – Measured Maximum Noise Levels in Descending Order

Exceedance number	Corrected $L_{Amax,f}$ (dB)
1	57
2	55
3	54
4	53
5	53
6	53
7	53

8	53
9	52
10	52
11	51
12	51
13	50
14	50
15	50
16	50
17	49
18	48
19	47
20	47

The table shows the number of exceedances over the 23:00-07:00 night-time period is 20.

Discussion

The results of our measurements demonstrate that, in the bedroom overlooking the train line, the average daytime noise level is 32dB $L_{Aeq,16hours}$, which is 3dB below the daytime average noise level criterion of 35dB $L_{Aeq,16hours}$. The average night-time noise level is 27dB $L_{Aeq,16hours}$, which is 3dB below the night-time average noise level criterion of 30dB $L_{Aeq,16hours}$.

In terms of maximum noise events, there will be approximately 20 exceedances of 45dB $L_{Amax,f}$ per night when rooms are fully furnished based on corrections applied through assessment of the apparent reverberation time.

Conclusion

Internal noise measurements have been undertaken in the worst-case bedroom of 29 Berry Brow, Clayton, to determine the level of noise ingress into the development from external noise sources.

We hope the above is clear and of assistance.

Yours sincerely,
For RBA Acoustics



Suzy Everett

APPENDIX A – REVERBERATION TIME CORRECTION CALCULATIONS

Surface area (S)= 48m²
 Volume (V) = 23m³

Reverberation Time Corrections Room

Parameter	Parameter value at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Bedroom – assumed average absorption coefficient (a)	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Equivalent absorption area, A (m²) [S x a]	7.3	8.7	12.1	13.1	15.0	15.5	15.5	15.5
Apparent reverberation time T ₀ (s) [T ₀ = 0.161 * V / A]	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2
Measured reverberation time T (s)	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.6
RT Correction [dB] [10 * Log ₁₀ (T/T ₀)]	-0	-2	-4	-5	-5	-5	-5	-4

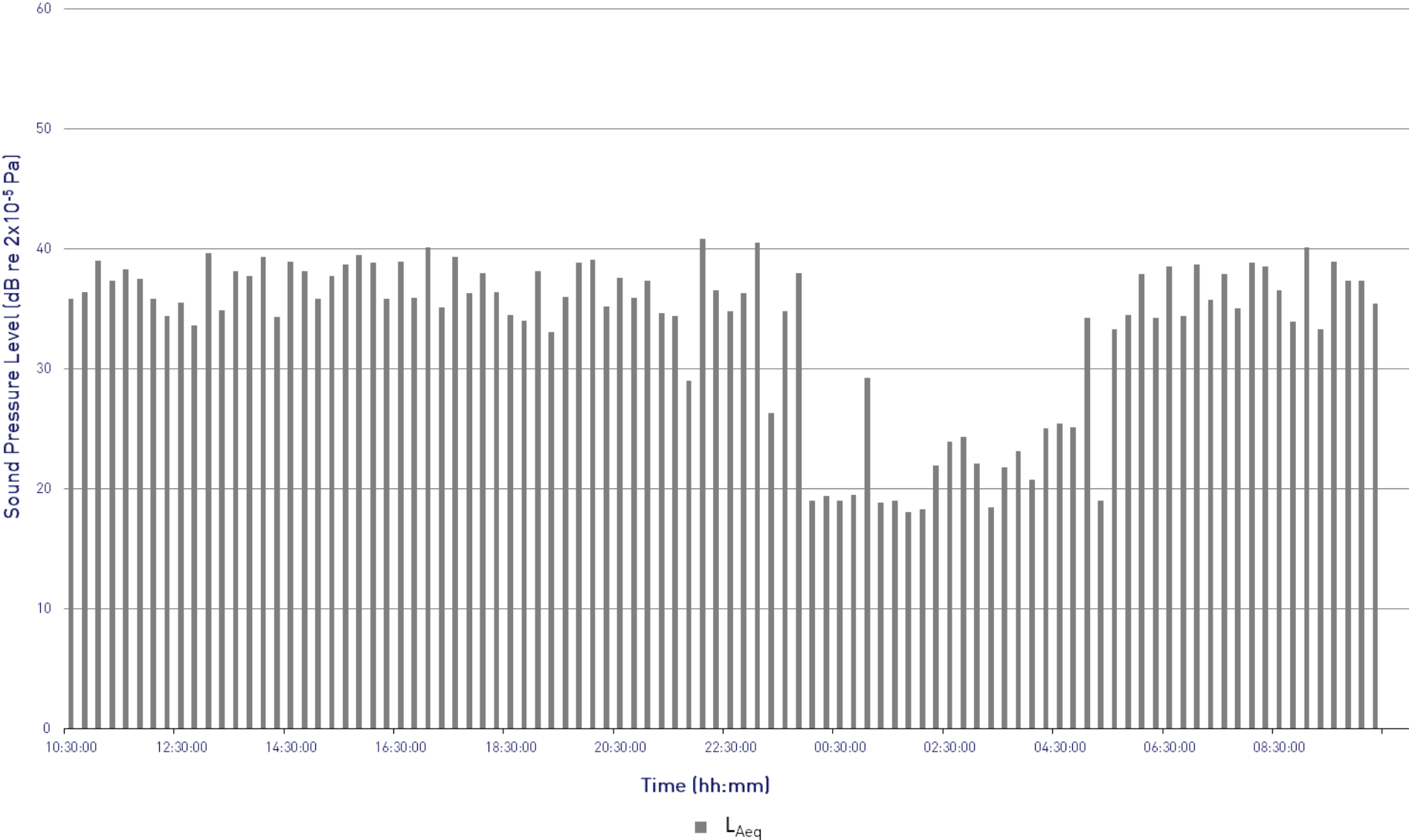
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L_{Aeq} Time History



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Graph 1



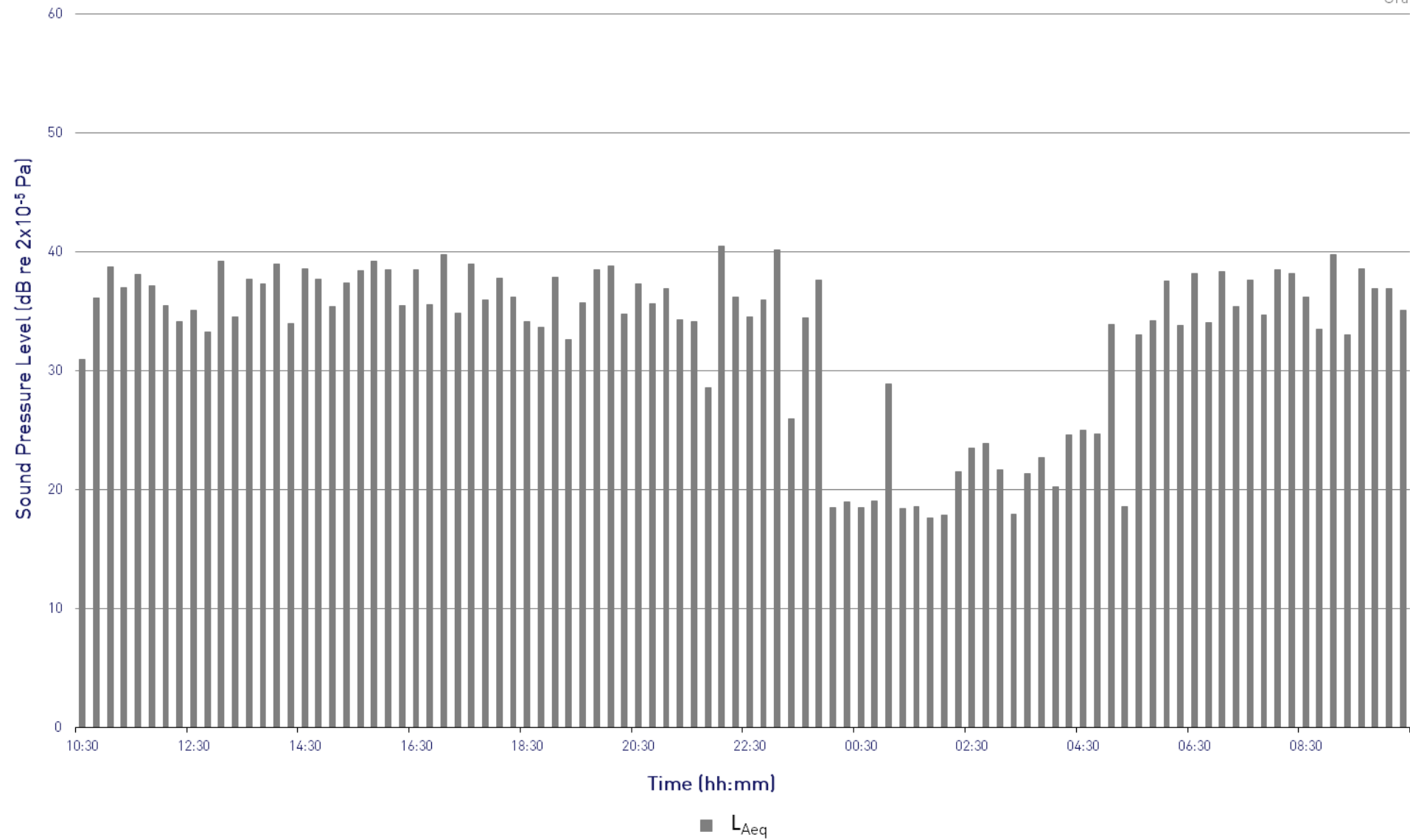
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L_{Aeq} Time History - Reverberation Time Corrected



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Graph 2



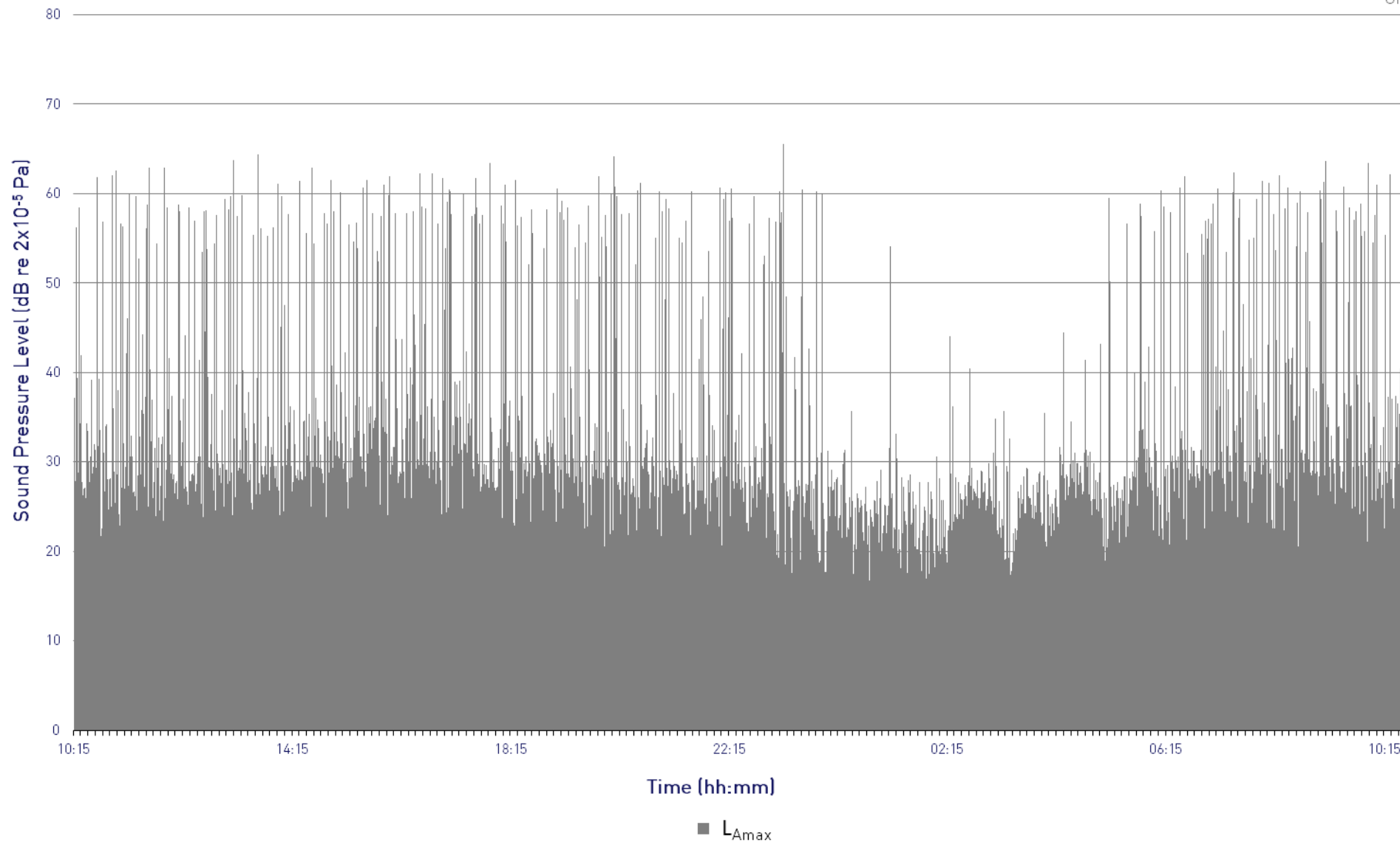
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L_{Amax} Time History



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Graph 3



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L_{Amax} Time History - Reverberation Time Corrected



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Graph 4

